COSM Physics News

February 2, 2015

Georgia Southern University

Professor Xiao-Jun Wang appointed as Editor

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Professor Xiao-Jun Wang of the COSM Physics Department was appointed as an editor of Materials Research Bulletin (a journal of Elsevier), managing the research area of luminescence. He also continues to serve the editorial boards for Light:Science & Applications (Nature Publishing Group), Journal of Rare Earths (Elsevier), and Chinese Journal of Luminescence.

Updates from the Physics Nanotechnology Computational Group

February 2, 2015

In the Nanotechnology Computational Lab: from left to right – Emile Maroha, Dr. Maxim Durach, Matthew LePain, and David Keene.

The COSM Physics Department Nanotechnology Group, led by Professor Maxim Durach, conducted research of plasmonic drag effects in metals with nanostructured surfaces. They established that the two known mechanisms of plasmonic drag are important in different power regimes and are currently investigating in detail the weak-power plasmonic pressure mechanism. They have also been investigating optical properties of metal metasurfaces and discovered new hyperbolic resonances of those metasurfaces and metasurface cavities with unique polarization and power-distribution properties and anisotropic dispersion.

These results have been published in a number of peer reviewed journals and presented at several conferences, including the Frontiers in Optics Conference by major David Keene and the Georgia Undergraduate Research Conference by major Matthew Lepain.

To fund this research a grant titled “Collaborative Research: Coupling of Plasmonic and Electric Effects in Nanostructured Metal” has been submitted to the National Science Foundation (NSF).

Updates from the Astrophysics Group

February 2, 2015

ALMA

To the right are the results of observations taken with the Atacama Large Millimeter Array (ALMA) high in the Chilean Andes by Drs. James & Sarah Higdon of the COSM Physics Department to measure the distribution and motions of cold molecular gas in the Cartwheel ring galaxy. Ring galaxies are created when a small neighbor galaxy crashes through the center of a large spiral galaxy. Such a collision creates a series of rings that move outward at speeds in excess of 150,000 mph. The Cartwheel’s ring appears bright blue in the optical photograph due to the presence of large numbers of young massive stars. These stars form out of giant clouds of cold gas and the ALMA observations will shed light on how stars form. Surprisingly cold gas was only found in the galaxy’s small nucleus and inner ring, which are forming stars slowly. The distribution of gas is shown using yellow contour lines. Additional analysis of the ALMA data have uncovered very small amounts of cold molecular gas in the blue outer ring, which tells us that the rings of these systems form stars very efficiently and have nearly exhausted their gas reservoirs. These results will appear in the Astrophysical Journal Letters.

Alma observatory results of the Cartwheel ring galaxy by Drs. James & Sarah Higdon of the COSM Physics Department. The distribution of gas is shown using the yellow contour lines.

In addition to observing with ALMA remotely, Georgia Southern Physics Department Professor James Higdon traveled to the high Atacama Plain (3.2-miles above sea level) in September and November 2014 to study star formation in extremely distant galaxies using Zeus-2, a sensitive spectrograph operating at

sub-millimeter wavelengths. This project, in collaboration with Cornell University, is intended to better understand the history of star formation in the universe. The September trip was funded by a COSM travel grant. Dr. Higdon also traveled to the National Radio Astronomy Observatory's headquarters in Charlottesville, Virginia to conduct the initial analysis of the ALMA observations of the Cartwheel galaxy. This work of Drs. Sarah and James Higdon was funded by an NSF grant to study star formation and the interstellar medium of nuclear starburst rings using observations over a wide range of wavelengths, including ALMA.

GRAM

Professor Monique Aller took a group of physics department majors (Will LePain, DJ Cistola, Julian Hershey, and Billy Brewer) to the 2014 Georgia Regional Astronomers Meeting (GRAM) held at the Tellus Museum in Cartersville on Saturday, October 25, 2014, where she presented a talk on "Interstellar Silicate Dust Properties in Quasar Absorption Systems at Redshifts z<1.4". This annual meeting of astronomers, astrophysicists, and planetary scientists of all backgrounds and expertise featured planetarium demonstrations, scientific posters, talks on topics ranging from cutting-edge research to programs for students, and sunspot viewing through the Tellus Observatory 20″ telescope.

Professor Aller has also begun working on a project to study the co-evolution of dust and gas in distant galaxies, as part of a 3 year (mid 2014-mid 2016) NASA Astrophysics Data Analysis Program grant ($313k) entitled "Connecting the Interstellar Gas and Dust Properties of Distant Galaxies". Dr. Aller is the science-PI of this project and is leading the study of dust grain properties in distant galaxies over the past 10 billion years, in collaboration with Dr. V.P. Kulkarni (University of South Carolina, PI), who is leading the associated study of the galaxy gas properties, and Dr. E. Dwek (NASA-GSFC, co-I), who will be developing models to explain the observed gas-dust connections in the context of galaxy evolution.

Professor Aller presented her lasted results at the 225th Meeting of the American Astronomical Society held January 4-8, 2015 in Seattle, WA where she presented a poster on "Interstellar Silicate Dust Grain Properties in Distant Galaxies Probed by Quasar Absorption Systems".

Georgia Association of Museums and Galleries

February 2, 2015

The Georgia Southern Museum was proud to host the Annual Conference of the Georgia Association of Museums and Galleries this year in mid-January. Nearly one-hundred and twenty-five museum professionals from across the state gathered for the three day workshop filled with presentations and spurts of entertainment as attendees reach to grow in their respective museum professions. One of the highlights of the event is a progressive dinner on opening night of the workshop. Dessert was to be held in the Georgia Southern Museum and fitting into the Mad Scientist exhibit was our Physics Department yet again demonstrating the physics of liquid nitrogen ice cream making. Guests gathered around as Physics Major, Dillon Marcy, and Instructor, Ms. Ashley August, gave an explanation of the physics behind the culinary treat. Guests were also encouraged to participate in an interactive demonstration with Mr. Marcy regarding how liquid nitrogen affects other objects besides just milk and sugar. The event was a great success thanks to Dr. Brent Tharp, Director of the Georgia Southern University Museum. In the future months, Dr. Tharp and Ms. August plan on hosting an outreach event for local students utilizing the resources at the museum as well as the in the Physics Department.